JSCE's Coping Strategy at Task Force for Infrastructure Maintenance and Renewal

Japan Society of Civil Engineers

IMPLEMENT PROPER MAINTENANCE AND RENEWAL ON INFRASTRUCTURE – *NEEDS, 1/4*

INFRASTRUCTURE

↓

Base for social and economic activities

↓

Aging keeps going

↓

If not properly maintained, it makes difficult to:

- ✓ ***Maintain safe and wealthy people's living***
- ✓ ***Sustainably contribute to vigorous social economic growth***

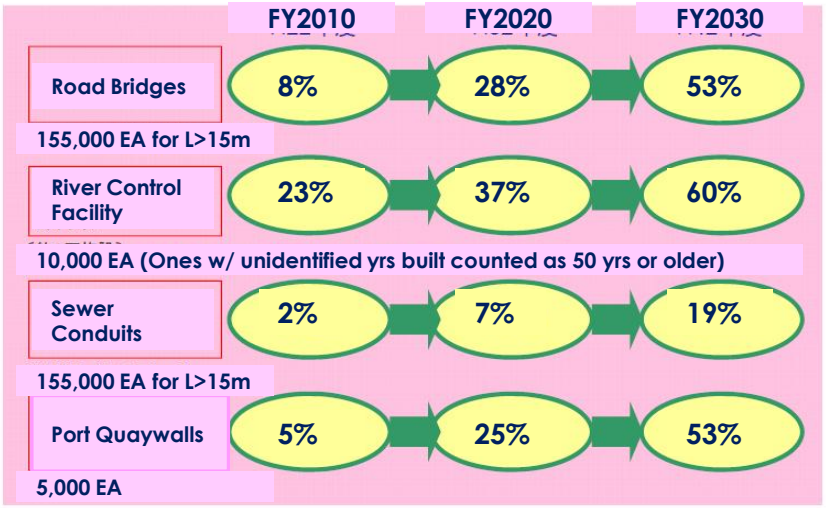
Collapse of Bridge in Minnesota
Source: Minnesota Department of Transportation

Fall of Ceiling/Bulkhead Boards at Sasago Tunnel, Japan

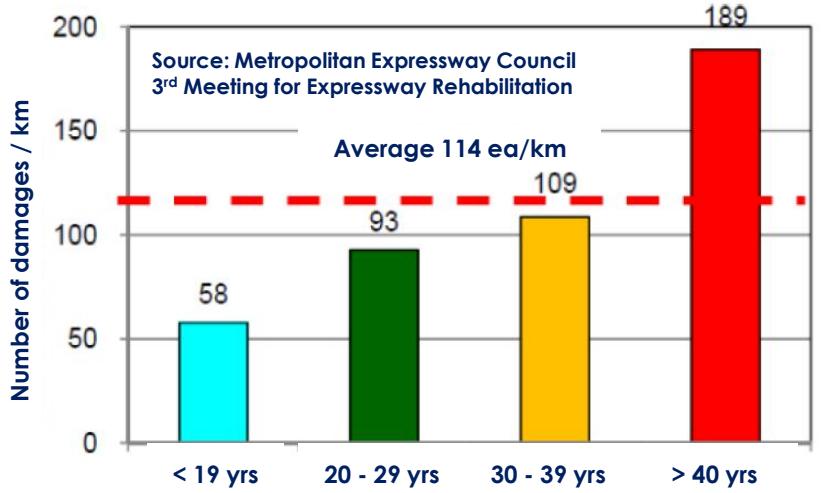
Source : Ministry of Land, Infrastructure, Transport and Tourism

IMPLEMENT PROPER MAINTENANCE AND RENEWAL ON INFRASTRUCTURE – 2/4

Aging of Japan's Infrastructure



Ratios of infrastructure of 50 years or older since service commencement



Number of damages per kilometer and years of service at Metropolitan Expressway (as of Apr 2011)

Mumei Bridge (Two-span steel simple truss) fell in 2007 at the border of Kagawa and Tokushima Prefectures

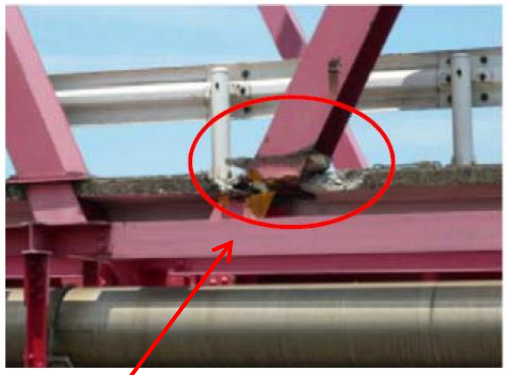
Car accident induced by road cave-in above sewer conduit in Nagoya City in 2009

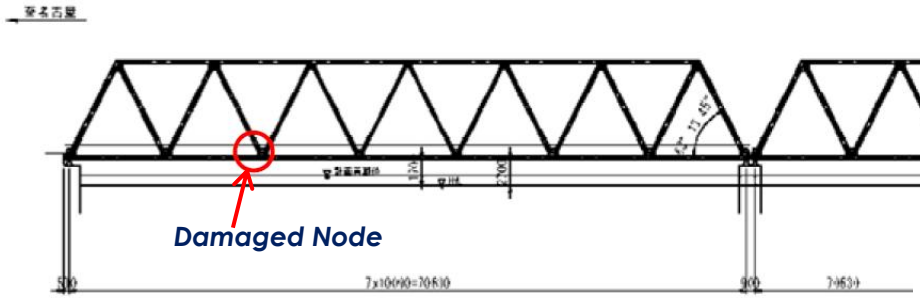
Damage examples from infrastructure aging

Source : Ministry of Land, Infrastructure, Transport and Tourism

IMPLEMENT PROPER MAINTENANCE AND RENEWAL ON INFRASTRUCTURE – 3/4

Example 1 – Damage on Kisogawa Bridge





Kisogawa Bridge

- *National Highway Route 23 in Kuwana-City, Mie Pref.*
- *Steel simple truss L=858.5 meters and W=11.8 meters*
- *Built in 1963*
- *53,000 vehicles/day*

Steel Rupture

Repair

Gusset Plates

Saddle, temporary support

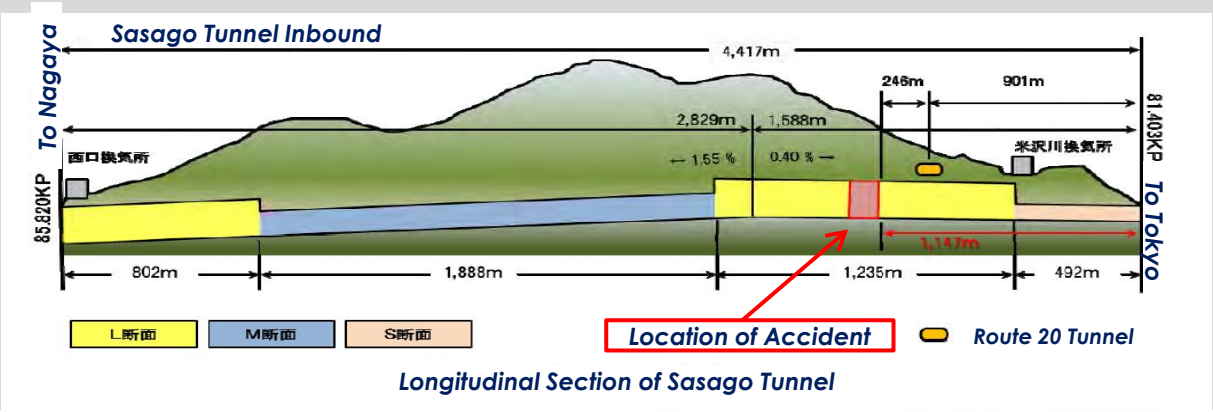
Complete

Source : Ministry of Land, Infrastructure, Transport and Tourism

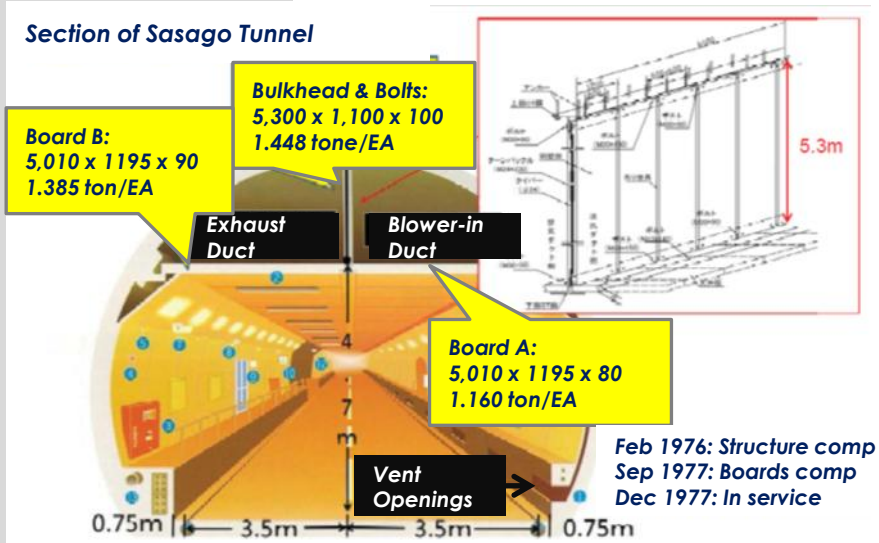
IMPLEMENT PROPER MAINTENANCE AND RENEWAL ON INFRASTRUCTURE – 4/4

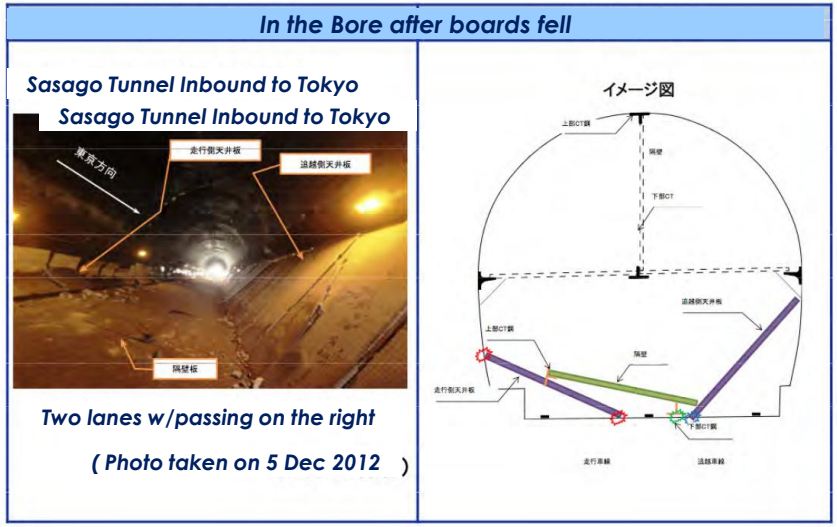
Example 2 – Accident at Sasago Tunnel

The accident occurred in Sasago Tunnel, Chuo Expressway Inbound towards Tokyo at 0803hrs on 2 December 2012. Ceiling and bulkhead boards for ventilation fell along the inbound bore for 140 meters long. Three vehicles were caught by fallen ceiling boards to cause fire on two of them and nine dead and two injured.



Longitudinal Section of Sasago Tunnel





Source : Ministry of Land, Infrastructure, Transport and Tourism

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 1/9

- ✓ Infrastructure as important assets of the people
- ✓ Implement its maintenance and renewal in an efficient manner
- ✓ Civil engineers' important role

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 2/9

TOP PRIORITY ISSUE 1/5 – Systematize the knowledge on infrastructure maintenance and renewal

- ✓ Background
  - + The knowledge and technologies on infrastructure maintenance and renewal has been neither well developed nor systematized.
- ✓ Plans set out
  - + Address the issue of systematization of knowledge on infrastructure maintenance and renewal ("knowledge systematization") to establish "Infrastructure maintenance engineering".
- ✓ Actions to take
  - + Classify and systematize basic principles, terminology, technology, assessment methodology etc. and compile maintenance and renewal knowledge into textbooks/handbooks complying with knowledge systematization.

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 3/9

TOP PRIORITY ISSUE 2/5 – Procure and train researchers and engineers

- ✓ Background
  - + There are not enough resources in researchers and engineers who are with interdisciplinary wide-ranging knowledge and attention in addition to well-versed expertise in structural design, construction methodology, maintenance record compilation, environmental constraints etc.
- ✓ Plans set out
  - + Clarify capabilities and responsibilities required and draft new policies for training them.
- ✓ Actions to take
  - + Examine details and approaches for school and continuing education/training of specialists.

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 4/9

TOP PRIORITY ISSUE 3/5 – Establish legal and financial systems to support maintenance and renewal endeavors

- ✓ Background
  - + Legal and institutional obligations under existing circumstances for inspection, diagnosis, soundness decisions etc. are not sufficient for some infrastructure. Authorization given at maintenance and renewal sections is limited in promoting the works.
- ✓ Plans set out
  - + Examine and take aim to establish the enforcement of legal and systematical obligations and the arrangements which enable receiving technical supports from the outside of organizations.
- ✓ Actions to take
  - + Assess the structure and roles of the supporting organizations for regional infrastructure maintenance and renewal.

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 5/9

TOP PRIORITY ISSUE 4/5 – Adjust bidding system and contracts

- ✓ Background
  - + Maintenance works are relatively small and complicated and it makes efficient project implementation difficult for contractors.
- ✓ Plans set out
  - + Propose procurement schemes to enable technologies at private companies be fully exerted.
- ✓ Actions to take
  - + Create the guidelines for the contracts of comprehensive maintenance projects applying PPP/PFI schemes and of maintenance extending over certain long enough period for locally rooted contractors.

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 6/9

TOP PRIORITY ISSUE 5/5 – Seek people's understanding and cooperation

- ✓ Background
  - + Maintenance and renewal projects have not gained people's sufficient understanding although the efforts have actually been undertaken.
- ✓ Plans set out
  - + Cause people understand that the efforts for infrastructure maintenance and renewal are attractive and prideful works and get broad supports from the society.
- ✓ Actions to take
  - + Enhance attractiveness by creating story telling of the maintenance.

JSCE'S COPING STRATEGY AT TASK FORCE FOR INFRASTRUCTURE MAINTENANCE AND RENEWAL – 7/9

NEXT STEPS TO TAKE

JSCE will:

- ✓ Put these outcomes from the task force at the heart of its activities
- ✓ Propel researches on the coping strategy at research committees
- ✓ Promote cross-cutting approach by setting up ad-hoc committees
- ✓ Seek people's understanding through these approaches

EXAMPLES – MAINTENANCE AND RENEWAL IN JAPAN

- ✓ Lifetime improvement program for bridges
- ✓ Development on sensing and information technology

LIFETIME IMPROVEMENT PROGRAM FOR BRIDGES – 1/4

Preventive Maintenance Scheme for Road Bridges

Progressive Aging

Demands for upgraded performance

Current facts, however,

Don't Look | **Fail to Detect** | **Put off to Solve**

No change leads to

Increase of potentially accident-inducing bridges

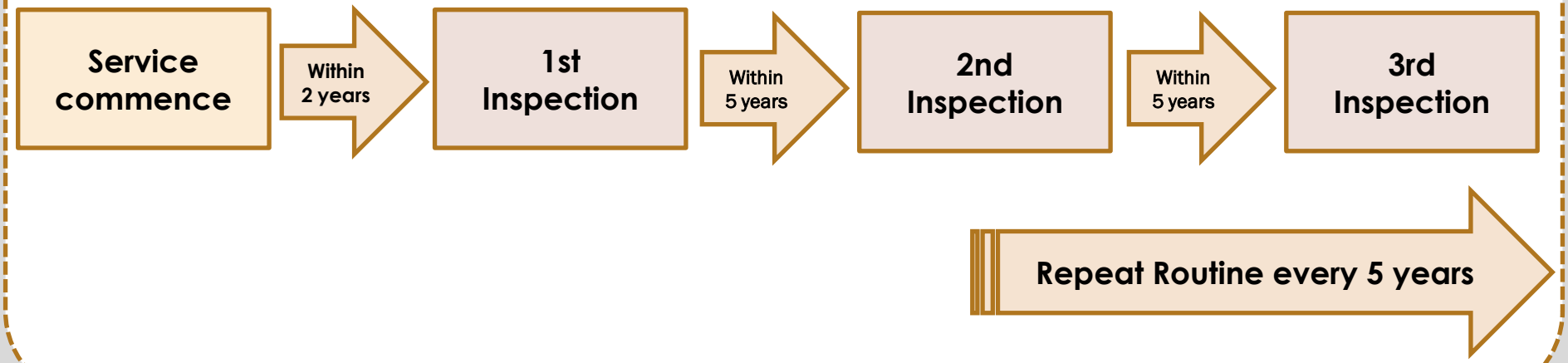
5 Plans for Inspection:
1. **Systematic implementation**
2. **Reliability Assurance**
3. **Technological Development**
4. **Provision of Base for 3.**
5. **Database Maintenance**

LIFETIME IMPROVEMENT PROGRAM FOR BRIDGES – 2/4

Bridge Inspection at National Highways of Central Government Administrated

Implement 1) the 1st inspection within 2 years after service commenced, and 2) routine inspection in every 5 years

<Outline of Routine Inspection>

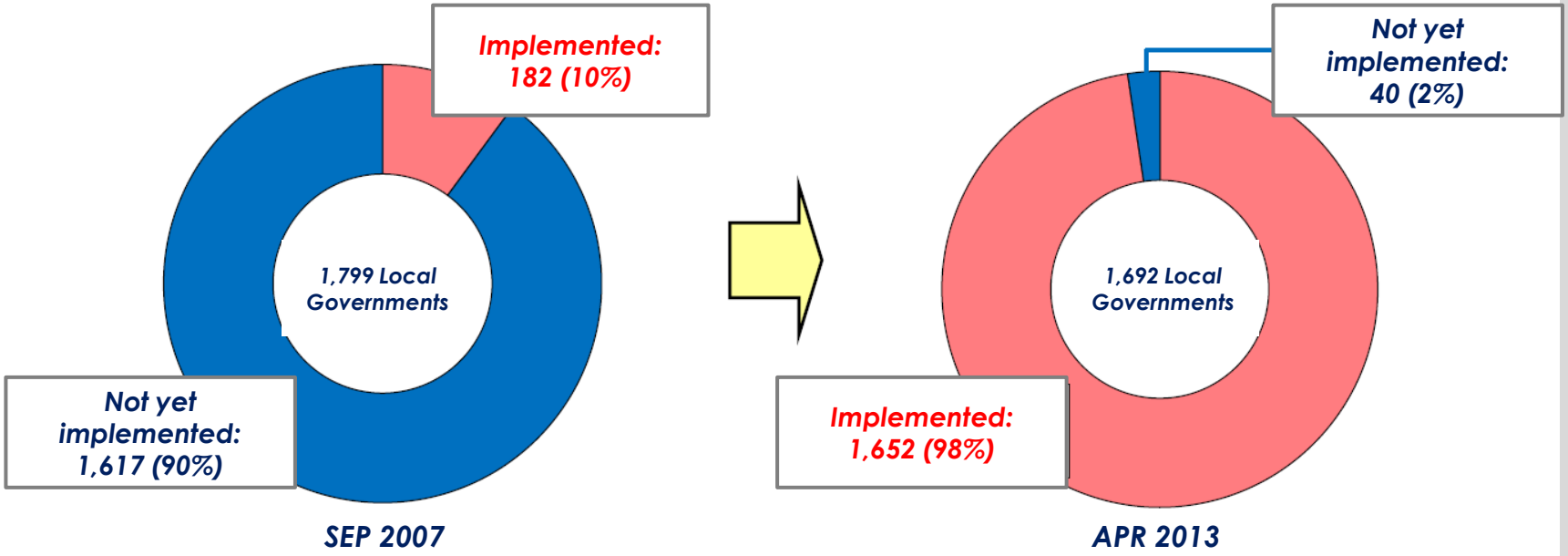


LIFETIME IMPROVEMENT PROGRAM FOR BRIDGES – 3/4

Status of Bridge Inspection by Local Governments

Out of 1,759 Local Governments, ones implementing inspection including routine and urgent counts 1,719 (98%) in April 2013;

- ✓ ***67 Prefectures and designated cities – 67 (100%)***
- ✓ ***1,692 municipalities – 1,652 (98%)***

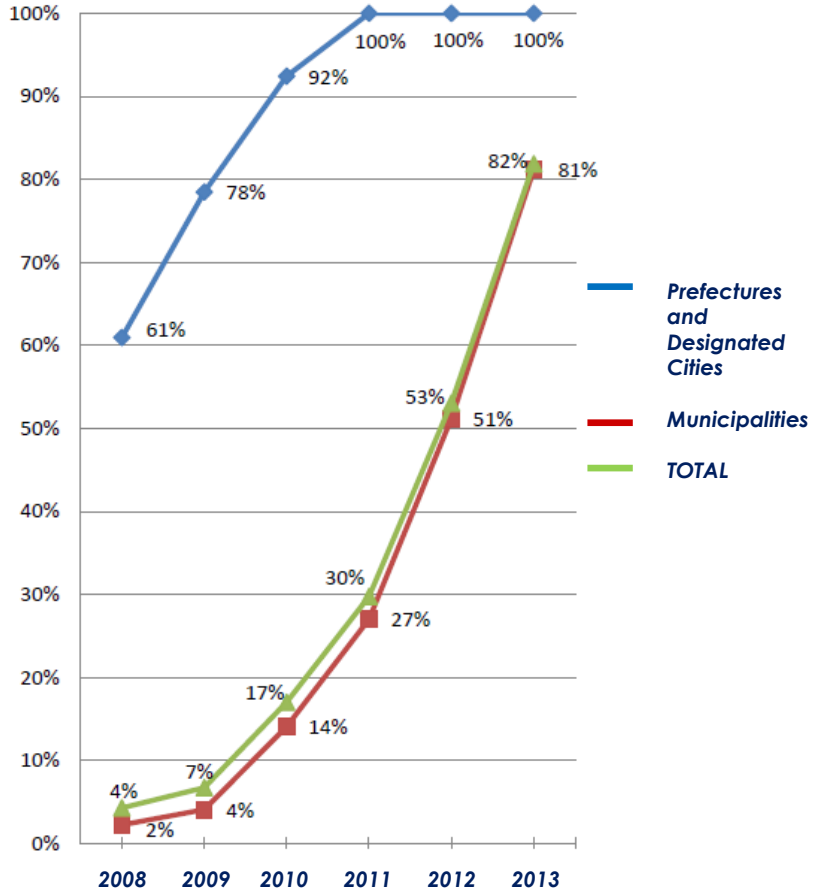


Source : Ministry of Land, Infrastructure, Transport and Tourism

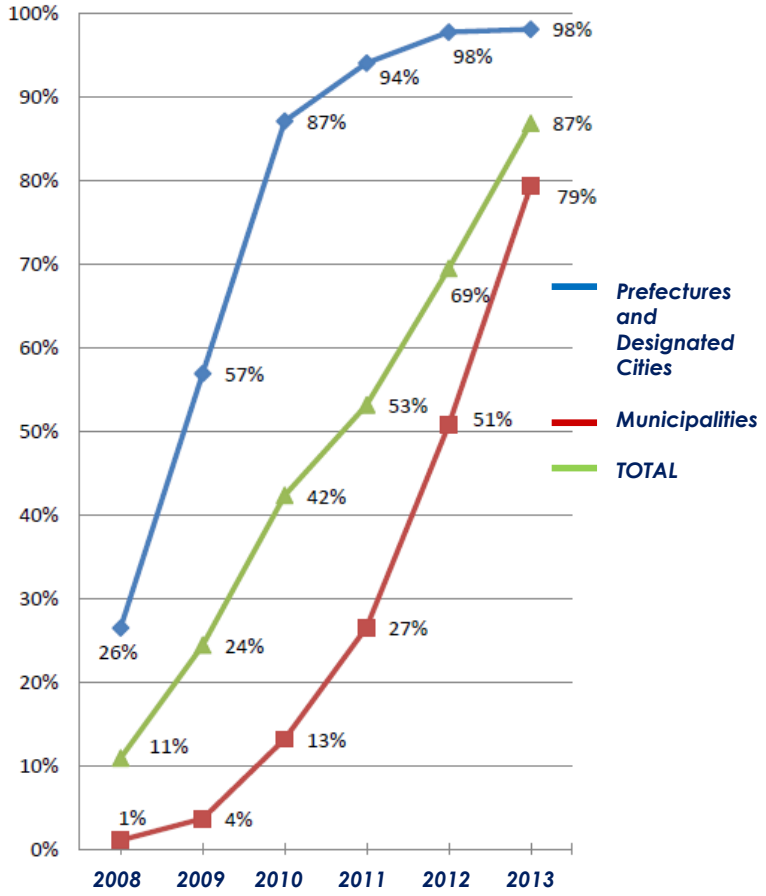
LIFETIME IMPROVEMENT PROGRAM FOR BRIDGES – 4/4

Set-up Ratio of Maintenance Program along Lifetime Improvement at Local Governments

Ration in Number of Local Governments



Ratio in Number of Bridges

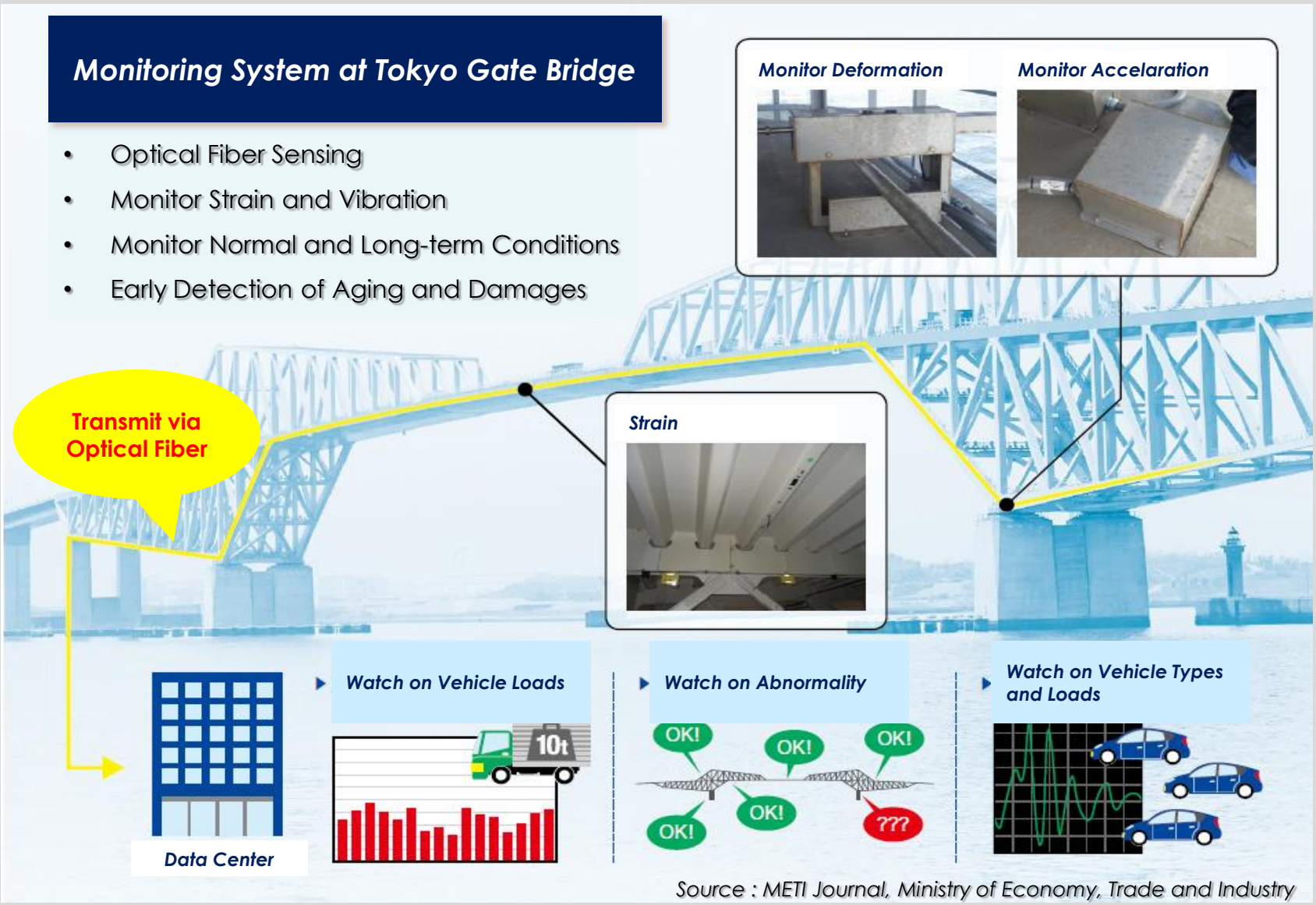


Source : Ministry of Land, Infrastructure, Transport and Tourism

DEVELOPMENT ON SENSING AND INFORMATION TECHNOLOGY – 1/2

Monitoring System at Tokyo Gate Bridge

- Optical Fiber Sensing
- Monitor Strain and Vibration
- Monitor Normal and Long-term Conditions
- Early Detection of Aging and Damages

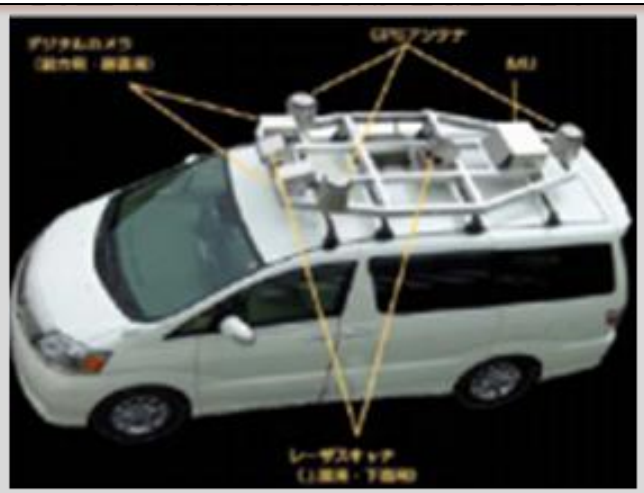


Source : METI Journal, Ministry of Economy, Trade and Industry

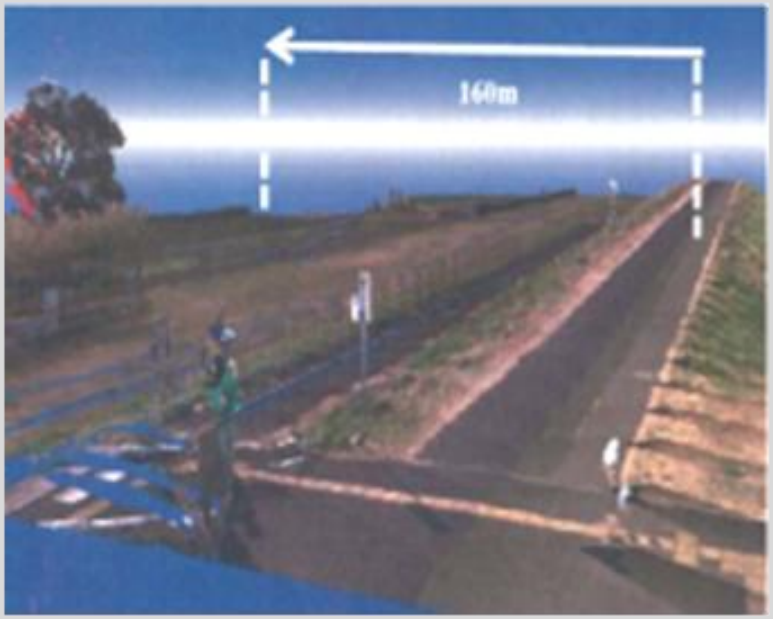
DEVELOPMENT ON SENSING AND INFORMATION TECHNOLOGY – 2/2

Research on Bank Deformation Detection Technology by Mobile Mapping System

Develop long–distance scanning device with high precision plus density and its data processing software to detect existing and potential damages, deformation and settlement on embankments by high resolution cameras and laser scanners mounted vehicles



Challenges – Innovate scanners to meet the above requirements from 100-meter distance and data processing software to grasp 3D deformation



Example scanned and processed data

Source : Ministry of Land, Infrastructure, Transport and Tourism

IMPLEMENT PROPER MAINTENANCE AND RENEWAL ON INFRASTRUCTURE

INFRASTRUCTURE

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Base for social and economic activities

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Aging keeps going

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If not properly maintained, it makes difficult to:

- ✓ ***Maintain safe and wealthy people's living***
- ✓ ***Sustainably contribute to vigorous social economic growth***

JSCE will put Top 5 Priority Issues proposed by its task force at the heart of activities:

1. *Systematize the knowledge on infrastructure maintenance and renewal*
2. *Procure and train researchers and engineers*
3. *Establish legal and financial systems to support maintenance and renewal endeavors*
4. *Adjust bidding system and contracts*
5. *Seek people's understanding and cooperation*

Address the issue of knowledge systematization to establish "Infrastructure maintenance engineering"